

CITY OF LINCOLN, NEBRASKA, STANDARD SPECIFICATIONS

Chapter 21

STORM SEWERS

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CHAPTER 21

STORM SEWERS

21.00 GENERAL

The work covered in this Chapter shall include the laying and jointing of storm sewer pipe, concrete box construction, concrete channel liners, and construction of storm sewer appurtenances.

21.01 RELATED ITEMS SPECIFIED ELSEWHERE

Chapter 9	Chain Link Fencing & Pipe Rail Fencing
Chapter 11	Portland Cement Concrete
Chapter 20	Construction for Utilities and Structures

21.02 MATERIALS

A. CONCRETE

Concrete used in storm sewer construction and reconstruction shall conform to the requirements of Chapter 11 of these Specifications for L-3500 Concrete.

B. REINFORCED CONCRETE PIPE

1. Reinforced concrete pipe shall be circular in cross section, unless otherwise indicated, with tongue and groove joints, and shall be manufactured in accordance with the requirements of "Standard Specifications for Reinforced Concrete Culvert Pipe, Storm Drain and Sewer Pipe", ASTM Designation C 76 for Class III Pipe with Wall B, unless otherwise specified on the plans or in the Special Provisions.
2. When so indicated on the plans, reinforced concrete elliptical pipe shall be supplied and shall be manufactured in accordance with the requirements of "Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain and Sewer Pipe", ASTM Designation C 507.
3. When so indicated on the plans, reinforced concrete D-load pipe shall be supplied and shall be manufactured in accordance with the requirements of "Standard Specification for Reinforced Concrete D-Load Culvert, Storm Drain and Sewer Pipe", ASTM Designation C 655.

C. RUBBER GASKET

Rubber gaskets shall be from extruded closed cell rubber.

1. The base polymer shall be a blend of neoprene and EPDM meeting the physical requirements of "Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber", ASTM D 1056, Class 2C2.
2. The closed cell rubber shall meet the ozone testing requirement of "Standard Test Method for Rubber Deterioration - Surface Ozone Cracking Outdoors or Chamber (Triangular Specimens)", ASTM D 1171, of seventy (70) hours at a forty degrees Celsius (40° C) at 100 PHM, bent loop with no cracks.

21.02 MATERIALS (Continued)

C. RUBBER GASKET (Continued)

3. Each seal shall be completely covered with a natural skin and shall be assembled into a continuous ring which shall conform to the joint size and shape.
4. Cross sectional dimensions shall conform to RMA Class II tolerances and installation shall be in accordance with the manufacturer's recommendations.

D. IRON CASTINGS

All iron castings shall meet the requirements of "Standard Specification for Gray Iron Castings", ASTM Designation A 48, Class 30. They shall conform in all respects to the designs for such castings as shown on the Standard Plans. All frames and covers shall be machined so that each cover will fit properly in its frame with no rocking. No casting will be accepted that is warped, cracked, has swells, or that has been plugged or filled.

E. CONCRETE REINFORCEMENT

1. **REINFORCEMENT BARS:** All reinforcement bars shall meet the requirements of "Standard Specifications for Deformed and Plain Billet Steel Bars for Concrete Reinforcement", ASTM Designation A 615, Grade 40 or Grade 60. Bars shall be free from excess rust, scale, or other substances which prevent the bonding of the concrete to the reinforcement.
2. **WELDED STEEL FABRIC:** Welded steel fabric shall consist of sheets or strips manufactured for this purpose. The steel wire shall comply with "Standard Specification for Steel Wire, Plain for Concrete Reinforcement", ASTM Designation A 82. Intersecting members shall be rigidly welded at right angles in such a manner as to develop the full tensile strength across the weld.

Steel fabric is specified on the plans by gauge and spacing of wires. The gauge number specified shall be in accordance with ASTM Wire Gauge Standard as given in the above reference.

3. **REINFORCEMENT BAR SUPPORTS:** Reinforcement bar supports shall be of a satisfactory design and of sufficient strength to hold the metal reinforcement in place while the concrete is being placed.

F. BRICK

All brick shall be clean, hard burned brick having true shape and sharp edges for their whole length. Unless otherwise specified, all brick shall be new brick. Broken brick shall be used only to close joints and no bats smaller than half a brick shall be used. In addition to the foregoing, all brick shall meet all the requirements of "Standard Specification for Sewer and Manhole Brick Made From Clay or Shale", ASTM Designation C 32; all sewer brick shall be Grade SS and all manhole brick shall be Grade MS. Concrete brick conforming to "Standard Specification for Concrete Brick", ASTM Designation C 55, Grade N 1, may be used in lieu of the clay or shale brick specified above.

21.02 MATERIALS (Continued)

G. MORTAR

Mortar used in the construction of manholes or other appurtenant structures shall be Type S as specified in "Standard Specification for Mortar for Unit Masonry", ASTM Designation C 270. Proportions of the mixture shall conform to either of the two following alternatives:

<u>Alternate</u>	<u>Portland Cement</u>	<u>Masonry Cement</u>	<u>Hydrated Lime or Lime Putty</u>	<u>Aggregate Loose & Damp</u>
1	1/2	1	0	Not less than 2 1/4 nor more than 3 times the sum of the volume of the cements and lime used
2	1	0	1/4-1/2	

H. PRECAST MANHOLE SECTIONS

Precast manhole sections shall be manufactured in accordance with the requirements of "Standard Specification for Precast Reinforced Concrete Manhole Sections", ASTM Designation C 478.

I. PRECAST BOX CULVERTS

When so indicated on the plans, precast box culverts shall be supplied and shall be manufactured in accordance with the requirements of "Standard Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains and Sewers", ASTM Designation C 1433.

J. WIRE GABION

GABION shall be supplied as specified, in various lengths and heights. The lengths shall be multiples of the horizontal width. The heights shall be fractions of the horizontal width. The horizontal width shall not be less than 3 feet. However, all gabion furnished by a manufacturer shall be of uniform width. Dimensions for heights, lengths and widths are subject to a tolerance limit of ± 5 percent of manufacturer's stated sizes.

GABION shall be fabricated in such a manner that the sides, ends, lid, and diaphragms can be assembled at the construction site into a rectangular basket of the specified sizes. GABION shall be of single unit construction. The base, lid, ends, and sides shall be either woven into a single unit or one edge of these members connected to the base section of the gabion in such a manner that strength and flexibility at the point of connection is at least equal to that of the mesh.

Where the length of the gabion exceeds its horizontal width, the gabion shall be equally divided by diaphragms of the same mesh and gauge as the body of the gabion into cells whose length does not exceed the horizontal width. The gabion shall be furnished with the necessary diaphragms secured in proper position on the base in such a manner that no additional tying at this juncture will be necessary.

GABION shall be made of hexagonal triple twist mesh 3 1/4 inches by 4 1/2 inches. The wire mesh shall be made of galvanized steel wire having a diameter of 0.1181 inches $\pm 2.5\%$. The tensile strength of the wire shall be in the range of 60,000 to 85,000 p.s.i. The minimum zinc coating of the wire shall be 0.80 ounces per square foot of uncoated wire surface in accordance with Federal Specification QQ-W-461g, Class 3.

All perimeter edges of the mesh forming the gabion shall be securely salvaged so that the joints formed by tying the selvages have at least the same strength as the body of the mesh.

21.02 MATERIALS (Continued)

J. WIRE GABION (Continued)

Tie wire or connecting wire shall be supplied in sufficient quantity for securely fastening all edges of the gabion and diaphragms. The tie wire shall meet the same specifications as the wire used in the mesh, except that it shall have a diameter of 0.0866 inches \pm 2.5%. Tie wire and connecting wire used for assembling or connecting to PVC coated gabion shall be PVC coated wire provided by the gabion manufacturer for that purpose.

The wire mesh for PVC coated baskets shall be made of galvanized steel wire and shall conform to all specifications for galvanized baskets except that the mesh wire exclusive of PVC coating may be 0.0118 inches smaller in diameter.

The PVC coating shall be a minimum of four-tenths millimeter in thickness. The PVC coating shall be applied prior to weaving of the baskets.

The PVC protective coating shall be resistant to the air and sea water and shall comply with the following test requirements:

1. Immersion of the wire for twenty (20) hours in Hydrochloric acid (solution composed fifty percent (50%) H₂O and fifty percent (50%) HCL concentration 21 Baume-Test temperature fifteen degrees Celsius (15°C) or immersion for sixty (60) hours in a saturated solution of salt water at fifteen degrees (15°C) without noticeable loss of weight due to corrosion of the coating material and without reduction of the wire's diameter.
2. After immersion of a length of the coated wire in a three and one-half (3.5%) solution of Potassium Permanganate (KMnO₄) for a continuous period of fifty hours (50) at an ambient temperature, the maximum penetration between the coating and the core wire from a square cut end shall be 0.472 inches .
3. The protective coating shall not be altered or deformed by temperatures ranging between 150.0°F and -40°F.

K. GABION STONE

The stone used to fill the gabion shall be from sources approved by the Engineer. The size of the stone shall be such that not more than five percent (5%) by mass shall pass the 4-inch sieve. The maximum weight for any one stone shall not exceed 50 pounds. The maximum length of stone shall not exceed 12-inches. Each stone shall have one dimension that has a measurement of 4-inches. The approved stone shall conform to the soundness requirements of "Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate", ASTM Designation C 88.

L. GROUT FILLED FABRIC

Grout shall consist of a mixture of Portland cement, fine aggregate, and water so proportioned and mixed as to provide a pumpable slurry. Pozzolan and grout fluidifier conforming to these Specifications may be used at the option of the Contractor. The mix shall exhibit a compressive strength of 2000 p.s.i. at twenty-eight (28) days when made and tested in accordance with "Standard Practice for Making and Curing Concrete Test Specimens in the Field", ASTM C 31 and "Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens", ASTM Designation C 39, or "Standard Test Method for Compressive Strength of Grouts for Preplaced-Aggregate Concrete in Laboratory", ASTM Designation C 942 if a grout fluidifier is used.

21.02 MATERIALS (Continued)

L. GROUT FILLED FABRIC (Continued)

Grout components shall conform to the following:

1. Portland cement: Federal Specifications SS-C 192 or "Specification for Portland Cement", ASTM Designation C 150.
2. Pozzolan, if used: "Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete", ASTM Designation C 618/C 618 M.
3. Water shall be fresh, clean, and free from injurious amounts of sewage, oil, acid, alkali, salts, or organic matter.
4. Aggregate: "Standard Specification for Concrete Aggregates", ASTM Designation C 33, except as to grading. Aggregate grading shall be reasonably consistent and shall be well graded from the maximum size which can be conveniently handled with available pumping equipment.
5. Grout fluidifier, if used: "Standard Specification for Grout Fluidifier for PrePlaced-Aggregate Concrete", ASTM C 937.

The average compressive strength of the grout-filled fabric test cylinders shall be at least twenty percent (20%) higher at seven days than that of companion test cylinders made in accordance with "Standard Practice for Making and Curing Concrete Test Specimens in the Field", ASTM Designation C 31, or "Standard Test Method for Compressive Strength of Grouts for Preplaced Aggregate Concrete in the Laboratory", ASTM Designation C 942 if grout fluidifier is used, and not less than 2500 p.s.i. at twenty-eight (28) days.

Fabric forming material shall be "Fabriform" or approved equal.

Fabric forming material shall consist of specially-woven multiple panels of double-layer, open-selvage fabric joined in a mat configuration. The two fabric layers shall each be no lighter than 18 x 18 count per inch, one thousand (1000) denier nylon or one thousand (1000) denier polyester tire cord, of which at least 50% by weight shall be producer-bulked continuous multi filament tire cord nylon. Fabric of equal or greater strength and porosity may be used with the approval of the Engineer. Fabric containing film type polypropylene fiber shall not be considered as an acceptable alternate by reason of its low strength, low bond to mortar and extreme sensitivity to ultraviolet degradation.

1. Filter Point fabric (designated as FP on drawings) shall consist of multiple panels of double layer fabric joined together in such a manner as to provide Filter Points on spaced centers for the relief of hydrostatic uplift pressure. Filter Points shall be woven in such a manner as to permit passage of ground water through the Filter Points. Filter Points shall be on approximately five inch or eight inch or 10 inch centers as woven and as indicated on drawings.
2. Uniform Cross Section Fabric (designated as UCS on drawings) shall consist of multiple panels of double layer fabric joined together by interwoven ties of a uniform length spaced no further apart than 3 inch centers. Hydrostatic uplift relief, where required, shall be provided by sewing together the two fabric layers at locations and in the manner indicated on the drawings or by inserting plastic tubes through the mat on specified centers. Filter cloth shall be placed beneath the mat if plastic or other type tubes are used to prevent passage of fines through the tubes. These tubes shall be installed in such a manner as to insure that no damage to filter cloth occurs.

21.02 MATERIALS (Continued)

L. GROUT FILLED FABRIC (Continued)

3. Individual mill width panels shall be cut to suitable length and the two layers of fabric separately joined edge to edge by means of nylon thread. The tensile strength of stitched joints shall be not less than 100 pounds per inch.
4. Fabric porosity is essential for the successful execution of this work. At the direction of the Engineer, the Contractor shall demonstrate the suitability of fabric design by injecting the proposed grout into six inch diameter sleeves under a pressure of 10 to 15 p.s.i. which shall be maintained by means of air pressure or a standpipe for ten (10) minutes. The sleeves shall be constructed of the same fabric used in the individual layers of fabric. Six inch by twelve inch test cylinders shall be cut from each specimen and tested in accordance with "Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens", ASTM Designation C 39.

M. GEOTEXTILE FILTER FABRIC

Geotextile filter fabric shall be of nonwoven needle punched construction and consist of continuous long chain polymeric fibers composed of polyester polypropylene, polyethylene, or polyamide. The fibers shall be oriented into a multi-directional stable network which retains their positions relative to each other and allows the passage of water as specified. The fabric shall be free of any chemical treatment or coating which reduces permeability. The fabric shall be puncture and tear resistant; mildew, rodent, insect, and rot resistant; freeze and thaw stable; and shall be inert to chemicals commonly found in acid or alkaline soils. The fabric shall be resistant to deterioration due to ultraviolet light and/or heat exposure. The geotextile shall conform to typical physical properties, as shown below:

<u>Physical Property</u>	<u>Test Procedure</u>	<u>Minimum Test Results</u>
Tensile Strength, wet, lbs.	ASTM D 1682	175 (80)
Elongation, wet, %	ASTM D 1682	65
Coefficient of Water Permeability, cm/sec.	Constant head	0.10
Puncture Strength, lbs.	ASTM D 751*	90
Mullen Burst Strength, psi	ASTM D 3786	335
Abrasion Resistance, lbs.	ASTM D 3884	55 (min.)
	Taber Test	
	(1000 revolutions, 1 kg. load/wheel)	
Pore Size - EOS	Corps of Engineers CW-02215	70-100
Ultraviolet Resistance % Strength Retention	ASTM D-1682 (After 500 Xenon Weatherometer Hours)	70

*Tension testing machine with ring clamp; steel ball replaced with a 5/16 inch diameter solid steel cylinder with hemispherical tip centered within the ring clamp.

The fabric shall have a minimum weight of 5 ounces per square yard.

The geotextile shall be furnished in a protective wrapping which shall protect the fabric from ultraviolet radiation and from abrasion due to shipping and handling.

21.02 MATERIALS (Continued)

N. POLYETHYLENE PIPE

When approved by the Public Works Director for use in the public right-of-way, shall be a high-density polyethylene corrugated pipe with an integrally formed smooth interior. Polyethylene pipe and fittings shall be made of polyethylene compounds meeting or exceeding the requirements of Corrugated Polyethylene Pipe 12" to 48" Diameter. All polyethylene pipe shall be affixed with a Plastic Pipe Institute 3rd Party Certification label as validation that the pipe meets or exceeds the material properties set forth in Corrugated Polyethylene Pipe 12" to 48" Diameter. Polyethylene pipe shall not exceed 36 inches in diameter and must have a minimum of 2 feet of backfill between the crown of the pipe and the sub-grade elevation for all surfaces that are to be paved. All backfill and bedding shall conform to the Lincoln Standard Plans and must be placed/compacted in layers not exceeding 8 inches loose lift thickness and brought up evenly and simultaneously on both sides of the pipe to an elevation of at least 2 feet above the crown (Note: bedding material must be hand placed). Pipe sections shall be joined with integral bell and spigot couplers having a rubber o-ring gasket meeting the requirements of Standard Specification for Elastometric Seals (Gaskets) for Joining Plastic Pipe (ASTM F477). Fittings shall be firmly secured with split couplings, corrugated to engage the pipe corrugations and shall engage a minimum of four corrugations, two on each side for the pipe joint. A neoprene gasket must be utilized with the coupling to provide a soil tight fitting. Whenever polyethylene pipe crosses any rigid structure or is connected to a rigid structure, flowable fill (controlled low strength mortar {CLSM} meeting the design approved by the City Engineer) shall be used in the trench in lieu of the rock bedding for a minimum of 5 feet along the longitudinal dimension of the polyethylene pipe and to a minimum of 1 foot above the crown of the pipe (Note: care should be taken to avoid 'floating' the pipe off grade when installing with flowable fill). All polyethylene pipe shall be mandrel tested, ten (10) days after the backfill is completed and any location which has a deflection exceeding 5%, shall be corrected and backfilled with CLSM to the same dimensions of those required for rigid structures.

21.03 EXCAVATION AND BACKFILL

Excavation and backfill shall conform to the requirements of Chapter 20 of these Specifications.

21.04 LAYING PIPE

For all ordinary laying conditions in firm soils, the Contractor shall lay each pipe to line and grade, taking care to provide depressions for jointing of each pipe.

All pipe shall be laid to line and grade as indicated on the plans. The laying of pipe shall begin at the lowest point in the line and proceed upgrade. Spigot ends shall be laid in the direction of flow. All pipe shall be so laid, fitted, and matched as to form a sewer with a smooth, uniform, and continuous interior surface throughout.

After each pipe has been laid and firmly bedded in place, the entire joint space and lift hole shall be completely filled with mortar composed of one (1) part Portland Cement and two (2) parts of clean sand by volume. If the pipes are of 36 inches in diameter or larger, the joint space shall also be filled on the inside surface of the pipe. The mortar shall be cured and protected as directed by the Engineer.

21.04 LAYING PIPE (Continued)

In lieu of the mortar joint specified above, joints may be made of approved rubber gaskets or cold mix asphalt jointing compound. The methods of making the joints and filling of lift holes shall be approved by the Engineer.

The open end of the pipes shall be protected at all times against the entrance of earth or other foreign material.

Tight bulkheads shall be placed in all open ends when pipe laying is stopped. The ditch or swale shall be graded as necessary to permit the proper entrance of surface runoff into or out of the system.

When called for on the plans, the Contractor shall remove and relay reinforced concrete storm sewer pipes to the lines and grades indicated. The Contractor shall exercise care in the removal so as not to damage the existing pipe or the pipe removed. Where pipes are unavoidably damaged, the Contractor shall replace the damaged pipe with new material and be compensated as provided below. Where, in the opinion of the Engineer, pipes are damaged due to neglect of the Contractor, the pipe shall be removed and replaced with new materials at the Contractor's cost.

When the plans or Contract Documents call for removal and salvage of storm sewer pipes, the Contractor shall remove and reuse the salvaged pipes. Where pipes are to be removed and salvaged but are, in the opinion of the Engineer, damaged beyond their usefulness, the Contractor shall be compensated for removal only and separately be compensated for new. When the plans or Contract Documents call for removal of storm sewer pipes, the Contractor shall remove and dispose of the pipes off the job site.

BASIS OF PAYMENT

Reinforced concrete storm sewer pipe, elliptical pipe, D-load pipe, and precast reinforced concrete box storm sewers, constructed in conformance with these Specifications and accepted by the Engineer, shall be measured from inside face of structure to inside face of structure, or to the end of the pipe or precast box for each size of pipe or precast box. Payment for pipes and precast boxes shall be made at the contract unit price bid per linear foot for ___ INCHES REINFORCED CONCRETE PIPE STORM SEWER, CLASS ___; ___ INCHES X ___ INCHES ELLIPTICAL REINFORCED CONCRETE PIPE STORM SEWER, CLASS ___; ___ INCHES REINFORCED CONCRETE PIPE STORM SEWER, D-LOAD = ___; or ___ FEET X ___ FEET PRECAST REINFORCED CONCRETE BOX STORM SEWER, for the various sizes shown on the proposal. Such payment shall be full compensation for all excavation, bedding, jointing, backfill, materials, equipment, tools, labor, and incidentals necessary to complete the items of work called for.

Reinforced concrete storm sewer pipe removed and relaid, removed and salvaged, or removed in accordance with these Specifications and accepted by the Engineer, shall be measured and paid for at the contract unit price bid per linear foot for REMOVE AND SALVAGE ___ INCHES REINFORCED CONCRETE STORM SEWER PIPE, REMOVE AND RELAY ___ INCHES REINFORCED CONCRETE STORM SEWER PIPE, or REMOVE ___ INCHES STORM SEWER PIPE. Such payment shall be full compensation for all excavation, removal, bedding if required, relaying, loading salvaged pipe, backfill disposal, materials, equipment, tools, labor, and incidentals necessary to perform the work called for.

Grading required as a part of storm sewer construction shall not be measured or paid for separately. The costs of such grading shall be considered as subsidiary to the costs of the items for which direct payment is made.

21.05 CURVED REINFORCED CONCRETE PIPE STORM SEWER

Straight sections of reinforced concrete pipe may be installed on curves by opening the outside of the joints in accordance with this Specification. Where reinforced concrete pipe is to be installed on radii smaller than those shown in this Specification, radius or beveled pipe shall be used only with the prior approval of the Engineer.

21.05 CURVED REINFORCED CONCRETE PIPE STORM SEWER (Continued)

Reinforced concrete pipe with mortar of mastic-packed joints shall have a maximum joint opening of not more than three-fourths (3/4) of the tongue length.

No separate measurement or payment shall be made for beveled or radius pipe. The measurement and payment for beveled and radius pipe shall be included in the measurement and payment for standard storm sewer pipes as provided in Section 21.04 of these Specifications.

TABLE 21.05 CURVED REINFORCED CONCRETE STORM SEWER PIPE

Nominal Diameter inches	Tongue Length inches	Maximum Joint Opening inches	Minimum Radius in feet for Given Laying Length (LL) (using unbeveled round pipe)			
			4 ft. LL	6 ft. LL	7.5 ft LL	8 ft. LL
15	2	1 ½	52	78	98	-----
18	2 ¼	1 ¾	53	79	99	-----
21	3 ½	2 5/8	41	61	76	-----
24	2 ¾	2 1/16	59	88	110	-----
30	3 ½	2 5/8	57	85	-----	108
36	3 ½	2 5/8	67	101	-----	129
42	4	3	68	102	-----	130
48	4 ½	3 3/16	73	110	-----	140
54	5	3 ¾	70	104	-----	131
60	5	3 ¾	77	115	-----	146
66	5	3 ¾	85	127	-----	161
72	5	3 ¾	92	138	170	174
78	5	3 ¾	100	149	184	188
84	4 ½	3 3/8	119	178	222	227

21.06 CONNECTIONS TO EXISTING STORM SEWERS

The Contractor shall make all connections and taps of the new storm sewers to existing storm sewer systems as shown on the plans. Existing manhole or inlet bottoms shall, if necessary, be reconstructed in substantially the same manner as herein specified.

BASIS OF PAYMENT

Connections to existing storm sewer systems, constructed in accordance with these Specifications and accepted by the Engineer, shall be measured and paid for at the contract unit price bid per each for TAP EXISTING STORM SEWER MANHOLE AND RESHAPE INVERT; TAP EXISTING STORM SEWER INLET AND RESHAPE INVERT; TAP EXISTING REINFORCED CONCRETE PIPE; or TAP EXISTING REINFORCED CONCRETE BOX, for each item called for in the proposal. No classification shall be made as to sizes of pipes being tapped or sizes of connecting pipes. Such payment shall be full compensation for all tapping, shaping the connecting pipes, brick, mortar, concrete, materials, equipment, tools, labor, and incidentals necessary to complete the taps and seal the resulting voids in the walls of the storm sewers in accordance with the details shown on the drawings.

No direct measurement or payment shall be made for connections or taps of various parts of the work to other parts of the work performed under the same contract. The cost of these taps and connections shall be considered subsidiary to the other items for which direct payment is made.

21.07 REINFORCED CONCRETE BOX STORM SEWERS AND STRUCTURES

A. GENERAL

Reinforced concrete box storm sewers and structures shall be complete, including box section, wing walls, apron, manholes, taps, connections, etc. Steel reinforcement shall be placed as indicated on the plans.

B. FORMS

Forms shall be true to the required shapes and sizes, properly braced, and strong and stiff enough to withstand, without springing or warping, all operations incidental to laying the mat of steel reinforcement and placing the concrete. They shall be mortar tight, and the form surfaces in contact with the concrete shall be smooth and clean. To prevent adhesion to the concrete, the contact surfaces of all forms shall be coated with soap, mineral oil, or other substances, and they shall be thoroughly wetted before the concrete is placed.

Tie wires and tie rods may be left in the concrete, providing the end portions are removed to within approximately two inches of any exposed face. All holes left after removal of the rod or wire ends shall be completely filled with cement mortar immediately after the concrete curing forms have been removed. Such mortar shall be kept moist until thoroughly bonded to the concrete. Before depositing any concrete in the forms, the Engineer or observer shall make an observation of the condition of the forms and the placing of the reinforcing steel. All imperfections in either shall be remedied before any concrete is placed.

During the process of placing the concrete in any formed section, a taut line shall be kept in place by the Contractor at the back side of the forms. Competent workers shall keep a constant check to determine any deflection of the forms. Any such deflection shall be corrected immediately.

21.07 REINFORCED CONCRETE BOX STORM SEWERS AND STRUCTURES (Continued)

B. FORMS (Continued)

The Contractor shall use great care in the removal of forms so as not to injure the concrete in any way, and he shall be wholly responsible for any injury due to premature removal of forms. Wall forms, normally, may be removed twelve to twenty-four (12 to 24) hours after placement of the concrete. Roof forms shall remain in place until tests show that the concrete has developed a compressive strength of 3000 p.s.i. Test specimens and tests shall comply with current ASTM Standards. Test specimens shall be cured under job conditions. In the absence of such tests, roof forms shall remain in place seven (7) days when the average ambient temperature has been 55° F for twelve (12) hours or more. Roof forms shall not be removed without permission of the Engineer.

C. STEEL REINFORCEMENTS

The exact position and bar size of the reinforcements are shown on the plans. Information for purchasing, cutting and bending the bars shall be furnished by the Contractor. The bars shall be secured in position by suitable means, so they will not be displaced during the process of depositing or consolidating the concrete.

Steel reinforcement shall be stored on the work site in such a manner as to protect it from any damage or surface deterioration.

Cold bends shall be made around a pin having a diameter of not less than six (6) times the nominal diameter of the bar.

All reinforcing steel shall be furnished in full length, except where splices are indicated in the plan or permitted by the Engineer. Splices in adjacent bars shall be staggered.

Unless otherwise shown in the plans, bars shall be spliced by lapping the ends. Laps shall be thirty-six (36) bar diameters for Grade 60, and twenty-four (24) bar diameters for Grade 40 (300). Lapped splices shall be made by securely wiring the bars in contact, maintaining alignment, and clearance.

BASIS OF PAYMENT

When called for in the proposal, payment for reinforcing steel for reinforced concrete box storm sewers and structures placed in conformance with these Specifications and accepted by the Engineer shall be made at the contract unit price bid per pound for **REINFORCING STEEL FOR BOX STORM SEWER, IN PLACE**, or for **REINFORCING STEEL FOR STRUCTURES, IN PLACE**. The reinforcing steel shall not be measured separately for payment, but the quantities shall be established based upon weight of steel required for the Design Section, unless otherwise specified. Such payment shall be full compensation for all placing, tying, chairs, materials, equipment, tools, labor, and incidentals necessary to place the steel in the proper locations in accordance with the plans.

When the plans or Special Provisions provide for unit price bids per linear foot or lump sum complete for box storm sewers or structures, the reinforcing steel shall not be paid for separately. The cost of the reinforcing steel shall be considered subsidiary to the costs for the items bid on the linear foot or lump sum basis as provided in Section 21.07 D.

21.07 REINFORCED CONCRETE BOX STORM SEWERS AND STRUCTURES (Continued)

D. CONCRETE

1. Placing Concrete

Before depositing any concrete, all dirt and other debris shall be removed from the forms. Concrete shall be handled by methods which will prevent the separation or loss of ingredients and the formation of laitance. The concrete shall be deposited in the work as nearly as possible in its final position to avoid rehandling. The concrete shall be deposited in level layers not exceeding 12 inches in thickness. Suitable means shall be provided to permit concrete to be placed in a manner that will avoid accumulation of dry or hardened concrete on the forms or reinforcement. Concrete, during and immediately after depositing, shall be thoroughly consolidated by the use of vibrators specified below. The greatest care must be exercised to ensure the coating of all surfaces of the reinforcement. Equal care shall be taken to ensure that all concrete is consolidated against the face of the forms.

2. Keyed Construction Joints

All keyed joints shall be of the raised type, and shall be thoroughly cleaned prior to successive concrete placements.

3. Curing Concrete

Precautions shall be taken to prevent excess loss of water from the concrete. The top of the floor slab and the top of the roof shall be sealed immediately after finishing by wet burlaps, plastic, or by spraying thereon a uniform application of membrane compound conforming to "Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete" ASTM Designation C 309 for Type 2, and at approximately the rate of one (1) gallon to each 150 square feet of surface. The area of the floor slab that will support the walls shall be cured with wet burlap or plastic sheeting. All exposed dowels in the floor slab shall be protected during the curing operation. When forms are removed before the concrete has reached an age of seven (7) days, the exposed concrete shall be cured as specified above.

4. Surface Finish

The upper surface of the floor slab and the top of the roof and end walls shall be finished straight and smooth to the designated lines and slopes. They shall be finished with floats and/or steel trowels. Exposed edges shall be chamfered a minimum of one inch or as otherwise directed by the Engineer. All exposed surfaces shall be finished with a Carborundum stone and water as soon as forms are removed. Upon removal of the forms, should any voids or other defects exist in the concrete surfaces, such defective concrete shall be removed at once and the space refilled with concrete and finished in a neat and workmanlike manner.

21.07 REINFORCED CONCRETE BOX STORM SEWERS AND STRUCTURES (Continued)

D. CONCRETE (Continued)

5. Backfill Around and Over Concrete Box

Backfill along and over the reinforced concrete box or structure sewer shall not be made until tests show that the concrete has developed a compressive strength of 3000 p.s.i. Tests and test specimens shall comply with current ASTM standards. In the absence of tests, the following times shall elapse prior to backfilling:

<u>MINIMUM AVERAGE AMBIENT TEMPERATURE</u>	<u>TIME</u>
45° F	17 Days
55° F	8 Days
73° F	5 Days

BASIS OF PAYMENT

When called for in the proposal, concrete for box storm sewers or structures placed in conformance to these Specifications and accepted by the Engineer shall be paid for at the contract unit price bid per cubic yard for CONCRETE FOR BOX STORM SEWER, IN PLACE, or for CONCRETE FOR STRUCTURES, IN PLACE. The concrete shall not be measured separately for payment, but the quantities shall be established based upon the volume of concrete required for the Design Section, unless otherwise specified. Such payment shall be full compensation for all mixing, hauling, forming, placing, jointing, curing, finishing, excavation, backfill, materials, equipment, tools, labor, and incidentals necessary to complete the structure.

When called for in the proposal, reinforced concrete box storm sewers constructed in conformance with these Specifications and accepted by the Engineer shall be paid for at the contract unit price bid per linear foot for ____ X ____ REINFORCED CONCRETE BOX STORM SEWER, COMPLETE, for the various sizes required. Such payment shall be full compensation for all excavation, bedding where required, forming, placing reinforcement, placing concrete, jointing, curing, finishing, backfill, materials, equipment, tools, labor, and incidentals necessary to construct the box and its appurtenances.

When called for in the proposal, reinforced concrete structures constructed in conformance with these Specifications and accepted by the Engineer shall be paid for at the contract unit price bid per lump sum for REINFORCED CONCRETE TRANSITION STRUCTURE @ STA. ____, COMPLETE, or REINFORCED CONCRETE STRUCTURE @ STA. ____, COMPLETE. Such payment shall be full compensation for all excavation, bedding where required, forming, placing reinforcement, placing concrete, jointing, curing, finishing, backfill, materials, equipment, tools, labor, and incidentals necessary to construct each structure and its appurtenances in a manner acceptable to the Engineer.

21.08 APPURTENANCES AND MISCELLANEOUS WORK

A. STORM SEWER MANHOLES

1. Brick Manholes

Brick manholes shall be built where and as indicated on the plans. Their form and dimensions shall be in accordance with the drawings included with these Specifications. The brick in each course shall break course with those in the adjoining courses. Mortar shall be mixed in the proportions of one (1) part of Portland or mortar cement and two (2) parts of sand, by volume. Every brick shall have full mortared joints on the bottom, sides and ends which shall be formed in one operation by placing sufficient mortar on the bed and forcing the brick into it. All joints shall be carefully filled and struck as the manhole is built up. The entire space between adjacent bricks shall be filled solidly with mortar. The entire inside and outside surface of the brick masonry shall be carefully plastered with mortar applied at a thickness of not less than one-half inch.

2. Reinforced Concrete Manholes

Reinforced concrete manholes shall be built in accordance with Section 21.07, "Reinforced Concrete Box Storm Sewers and Structures".

3. Precast Concrete Manholes

Concrete manholes may also be constructed of precast sections as provided in the Lincoln Standard Plans. In the assembly of the wall rings, mortar joints, rubber gaskets, or cold-formed asphalt, joints shall be used to make the walls watertight.

BASIS OF PAYMENT

Storm sewer manholes constructed in conformance with these Specifications and accepted by the Engineer shall be counted and paid for at the contract unit price bid per each for STORM SEWER MANHOLE, ___ INCHES, COMPLETE, for the various sizes required. Size of the manhole shall be identified as the largest nominal size of its intersecting storm sewers. Such payment shall be full compensation for all excavation, brick, mortar, castings, precast sections, reinforcement, concrete, backfill, materials, equipment, tools, labor, and incidentals necessary to complete each manhole.

B. STORM SEWER INLETS

1. Brick Inlets

Storm sewer inlets shall be constructed where and as indicated on the plans. Walls shall be of brick masonry laid as above specified for manholes. The inside and outside of the walls shall be plastered with mortar one-half inch (13 mm) thick.

Each inlet bottom shall be fully formed so as to make the curves of the tributary sewers, and all corners shall be filled with concrete as directed by the Engineer or observer. All inlet rings, covers, grates, and the forms and dimensions of all inlets shall comply with the City of Lincoln Standard Plans.

2. Reinforced Concrete Inlets

Reinforced concrete inlets shall be built as provided above and in accordance with Section 21.07, "Reinforced Concrete Box Storm Sewers and Structures". The concrete inlet tops shall be set to grade and sealed with mortar. The ring and cover shall be adjusted to grade with brick and mortar and shall be sealed inside and out with mortar.

21.08 APPURTENANCES AND MISCELLANEOUS WORK (Continued)

B. STORM SEWER INLETS (Continued)

BASIS OF PAYMENT

Storm sewer inlets constructed in conformance with these Specifications and accepted by the Engineer shall be counted and paid for at the contract unit price bid per each for ___ INCHES STORM SEWER INLET, COMPLETE; ___ INCHES STORM SEWER INLET USING SALVAGED TOP, COMPLETE; ___ INCHES CANTED STORM SEWER INLET, COMPLETE; ___ INCHES RADIUS STORM SEWER INLET, COMPLETE; or GRATE INLET, TYPE ___, COMPLETE, for the various sizes and types required. Such payment shall be full compensation for all excavation, brick, mortar, concrete, inlet top, castings, curb as called for on the Standard Plans, backfill, materials, equipment, tools, labor, and incidentals necessary to complete each inlet.

C. OPEN DITCHES

Open ditches shall be constructed in accordance with the lines and grades indicated on the plans and/or as directed by the Engineer.

BASIS OF PAYMENT

Open ditches constructed in conformance with these Specifications and accepted by the Engineer shall be measured using the end area method and shall be paid for at the contract unit price bid per cubic yard for CHANNEL EXCAVATION. The quantity to be used as the basis for payment shall be the quantity called for in the proposal, unless otherwise specified. Such payment shall be full compensation for all excavation, preparation of the banks for seeding when required, disposal of surplus materials, other materials, equipment, tools, labor, and incidentals necessary to complete the ditch or channel.

When indicated on the plans but not called for in the proposal, the cost of grading small ditches or reshaping ditches, as directed by the Engineer, shall not be measured or paid for directly. The cost of this work shall be considered subsidiary to the cost of the other items for which direct payment is made.

D. CONCRETE DITCH LINERS

Concrete liners for open ditches shall be built to lines, grades, and sections as shown on the plans.

BASIS OF PAYMENT

Concrete ditch and channel liners constructed in conformance with these Specifications and accepted by the Engineer shall be measured and paid for at the contract unit price bid per linear foot for ___ REINFORCED CONCRETE LOW FLOW LINER, or ___ REINFORCED CONCRETE CHANNEL LINER, for the various sizes required. Such payment shall be full compensation for all excavation, forming, reinforcement, concrete, finishing, jointing, curing, sealing, backfill, materials, equipment, tools, labor, and incidentals necessary to complete the liners.

E. CONVERTING APPURTENANT STRUCTURES

When called for on the plans, existing manholes shall be converted to inlets by removing the manhole top, castings and walls, replacing any brick which is damaged, placing the new inlet top to the proper elevation, and reforming the inlet throat and adjacent curbs as directed by the Engineer.

21.08 APPURTENANCES AND MISCELLANEOUS WORK (Continued)

E. CONVERTING APPURTENANT STRUCTURES (Continued)

When called for on the plans, existing inlets shall be converted to man holes by removing the inlet top, throat and adjacent curbs, bricking up the throat, removing and reshaping the invert if necessary, placing a new inlet top, and installing a new manhole ring and cover as directed by the Engineer.

BASIS OF PAYMENT

Manholes converted to inlets and inlets converted to manholes in accordance with these Specifications and accepted by the Engineer shall be counted and paid for at the contract unit price bid per each for CONVERT MANHOLE TO INLET, COMPLETE, or CONVERT INLET TO MANHOLE, COMPLETE. No classification shall be made as to size for either pay item. Such costs shall be full compensation for all excavation, backfill, curb removal, curb replacement, materials, equipment, tools, labor, and incidentals necessary to complete each conversion.

F. REINFORCED CONCRETE ELBOWS AND COLLARS

When called for on the plans, the Contractor shall construct reinforced concrete collars or elbows at the locations indicated. The collars and elbows shall conform to the details shown on the drawings.

Measurement and payment for reinforced concrete collars and elbows shall conform to Section 21.07 of these Specifications.

G. REINFORCED CONCRETE FLARED END SECTIONS

When called for on the plans, reinforced concrete flared end sections, with or without grates, shall be installed at the locations and grades indicated.

When called for on the plans, flared end sections shall be removed and salvaged to a location on the job site as directed by the Engineer.

When called for on the plans, the Contractor shall remove existing flared end sections from the existing system, store the end sections on the job site, and reset the end sections at new locations as a part of the work.

Flared end sections required to be removed and salvaged or removed and reset but damaged by the Contractor shall be replaced with new materials at the Contractor's cost.

Flared end sections to be removed and not salvaged or reset shall be disposed of by the Contractor.

BASIS OF PAYMENT

Flared end sections and flared end sections with grates, placed in conformance with these Specifications and accepted by the Engineer, shall be counted and paid for at the contract unit

21.08 APPURTENANCES AND MISCELLANEOUS WORK (Continued)

G. REINFORCED CONCRETE FLARED END SECTIONS (Continued)

price bid per each for ____ REINFORCED CONCRETE FLARED END SECTION and ____ REINFORCED CONCRETE FLARED END SECTION WITH GRATE, for the various sizes called for in the proposal.

Flared end sections to be removed and salvaged, removed and reset, or removed, in accordance with these Specifications and accepted by the Engineer, shall be counted and paid for at the contract unit price bid per each for REMOVE AND SALVAGE ____ REINFORCED CONCRETE FLARED END SECTION; REMOVE AND RESET ____ REINFORCED CONCRETE FLARED END SECTION; or REMOVE ____ REINFORCED CONCRETE FLARED END SECTION. Such payment shall be full compensation for all excavation, backfill, bedding, jointing, materials, equipment, tools, labor and incidentals necessary to install the end sections at the locations shown on the plans, or to remove and salvage, remove and reset, or remove and dispose of the end sections.

H. REMOVAL OF EXISTING STRUCTURES

When called for on the plans the Contractor shall remove appurtenant structures from the existing system. The resultant exposed ends of the system shall be either made ready to connect system extensions or plugged with permanent or temporary plugs, as indicated.

BASIS OF PAYMENT

The removal of existing appurtenant structures as called for on the plans, completed in conformance with these Specifications and accepted by the Engineer, shall be counted and paid for at the contract unit price bid per each for REMOVE EXISTING MANHOLE, COMPLETE; REMOVE EXISTING INLET, COMPLETE; REMOVE EXISTING INLET, SALVAGE TOP, COMPLETE; REMOVE EXISTING JUNCTION BOX, COMPLETE; REMOVE EXISTING GRATE INLET, COMPLETE; or REMOVE EXISTING HEADWALL, COMPLETE. No classifications shall be made as to size of the structure or appurtenance. Such payment shall be full compensation for all excavation, removal to the line indicated, salvage of inlet tops if required, plugging, preparation of existing surfaces, backfill, materials, equipment, tools, labor, and incidentals necessary to complete the removal.

I. RIP-RAP

Concrete or stone rip-rap shall be placed on prepared slopes and channel bottoms at locations shown on the plans. The materials used shall be hard stone, broken concrete, or prepackaged material, free from earth, clay, asphalt or refuse and of such quality that it will not disintegrate from action of water or wind. Sizes of the material shall generally conform to the requirements of the plans or Special Provisions. Soundness specifications shall not apply to concrete rip-rap.

Geotextile conforming to the requirements of Chapter 32 of these Specifications shall be placed on the prepared slopes prior to placement of the rip-rap. Placement of the geotextile shall be considered subsidiary to the placement of the rip-rap.

Concrete or other masonry produced as a result of removal of such items at the job site may be used only with prior approval of the Engineer.

21.08 APPURTENANCES AND MISCELLANEOUS WORK (Continued)

I. RIP-RAP (Continued)

The rip-rap shall be placed at the locations and thicknesses indicated on the plans. Any appreciable variation from specified thickness shall be corrected by redistributing the rip-rap.

BASIS OF PAYMENT

Rip-rap placed in conformance with these Specifications and accepted by the Engineer shall be measured by weighing the truck. Tare weight shall be the basis of payment. Payment shall be made at the contract unit price bid per ton for RIP-RAP, IN PLACE. No measurement or payment shall be made for rip-rap produced as a result of removal of other items on the project. Such payment shall be full compensation for furnishing, preparation of slopes and subgrades, hauling, placing, excavation, backfill, materials, equipment, tools, labor, and incidentals necessary to complete the work.

21.09 GABION INSTALLATION

A. GENERAL

The Contractor shall furnish, assemble, tie, and fill gabion constructed in accordance with these Specifications and placed in conformity with the lines, grades, and dimensions shown on the plans or as directed by the Engineer. The location for installation of each type of gabion is indicated on the plans.

B. CONSTRUCTION DETAILS

1. Assembly

Each gabion unit shall be assembled by binding together all vertical edges with wire ties on approximately six inch (6") spacing or by a continuous piece of connecting wire stitched around the vertical edges with a coil about every four inches (4").

2. Placement

Prior to placement of gabion, the surface on which the gabion will bear shall be compacted and trimmed. Empty gabion units shall be set to line and grade as shown on the plans. Wire ties or connecting wire shall be used to join the units together. The units shall be tied together at all edges of their contact perimeters. Internal tie wires shall be uniformly spaced and securely fastened in each outside cell of the structure or where ordered by the Engineer. A standard fence stretcher, chain fall, or iron rod may be used to stretch the wire baskets and hold alignment.

3. Filling and Closing

The gabion shall be filled with the approved stone carefully placed by hand or machine to assure alignment and avoid bulges with a minimum of voids. Hand placing of the rock fill shall be used in the exposed faces of the gabion so that a pleasing and orderly arrangement of fill will result. The gabion shall be overfilled approximately two inches above the sides prior to closing the lids. The lid shall then be secured to the sides, ends, and diaphragms with the wire ties or connecting wire. Special attention shall be given to see that all projections or wire ends are turned into the baskets.

21.09 GABION INSTALLATION (Continued)

C. BASIS OF PAYMENT

The Contractor shall be paid for the actual number of baskets placed and filled at the contract bid price for "TYPE ___, WIRE GABION, IN PLACE" or "TYPE ___, WIRE GABION, PVC COATED, IN PLACE". Such payment shall constitute full compensation for all costs of labor, equipment, tools, and materials for furnishing, assembling, filling with stone, closing, all channel excavation, backfilling, and all incidental work necessary to complete the construction in accordance with these Specifications and as shown on the Plans.

21.10 GROUT-FILLED FABRIC CHANNEL LINER INSTALLATION

A. GENERAL

The work covered by these Specifications consists of furnishing all labor, materials, and equipment for installing grout-filled fabrics.

B. CONSTRUCTION DETAILS

The installation of grout-filled fabric erosion control mats shall be performed in accordance with provisions of these Specifications. The Contractor shall furnish records of past successful experience in performing this type of work and shall submit to the Engineer for approval a description of the materials to be used in the proposed method of operations, and shall furnish records and data to demonstrate that the finished mats will meet, in all respects, the quality and properties required by these Specifications. The Contractor shall save the City harmless from liability of any kind arising from the use of any patented or unpatented invention in the performance of this work.

1. Preparation of Surfaces

The slopes or surfaces to be protected shall be prepared and graded to such an extent that they are normally stable in the absence of erosive forces. The placement of fill material required to restore the slopes to acceptable and stable conditions shall be approved by the Engineer. A fabric envelope in a mat configuration shall be positioned over these surfaces and filled with a pumpable sand/cement grout in such a way as to form a stable mat of suitable weight and configuration.

2. Mixing and Pumping of Grout

Only approved mixing and pumping equipment shall be used in preparing and handling of the grout. All oil or rust inhibitors shall be removed from the mixing drums, stirring mechanisms, and other portions of the equipment in contact with the grout before the mixers are used.

All materials shall be accurately measured by volume or weight as they are fed into the mixer. The quantity of water shall be such as to produce a grout having a pumpable consistency. Time of mixing shall be not less than one minute. If agitated continuously, the grout may be held in the mixer or agitator for a period not exceeding two and one half hours (2 ½) in temperatures below 70° F and for a period not exceeding two hours at higher temperatures. If there is a lapse in a pumping operation, the grout shall be recirculated through the pump or through the mixer drum (or agitator) and pump.

21.10 GROUT-FILLED FABRIC CHANNEL LINER INSTALLATION (Continued)

B. CONSTRUCTION DETAILS (Continued)

3. Placement of Grout in Mat Fabric

Prior to grout injection, the fabric shall be positioned at its design location. Grout shall be introduced into the space between the layers of fabric and shall be injected in such a way that excessive pressure on the fabric envelope is avoided. Where convenient, adjacent fabric panels shall be joined before grout injection by field sewing the two layers of fabric separately, edge to edge. Where adjacent panels cannot be joined in this manner, or where called for by plans, adjacent panels shall be lapped a minimum of two feet. In no case shall simple butt joints be permitted.

Holes in the fabric left by the removal of the grout hose or inserts, shall be temporarily closed by inserting a piece of burlap or similar material. The burlap shall be removed when the mortar is no longer fluid and the surface is firm to hand pressure. Foot traffic on the filled revetment mats shall be limited to an absolute minimum for one hour after pumping in order to reduce indentation.

C. BASIS OF PAYMENT

Grout-filled fabric channel liner, constructed in accordance with the plans and these Specifications and accepted by the Engineer, shall be measured and paid for at the contract unit price bid per square foot for ___ GROUT FILLED FABRIC CHANNEL LINER, IN PLACE. Such payment shall be full compensation for all fabric forms, grout, filling the forms with grout, excavation, slope preparation, equipment, materials, tools, labor, and incidentals necessary to complete the work.

21.11 GEOTEXTILE FILTER FABRIC INSTALLATION

A. GENERAL

The work covered by these Specifications shall consist of furnishing all labor, materials, and equipment necessary for installing geotextile filter fabric as shown on the plans.

B. CONSTRUCTION

1. Weep Holes

Geotextile filter fabric shall be placed at weep holes for channel liners and retaining walls as shown on the plans.

2. Gabion/Embankment Stabilization

The gabion/embankment stabilization fabric shall be placed in the manner and at the locations shown on the project plans. The surface to receive the geotextiles shall be prepared to a smooth condition free of obstructions, depressions and debris. The fabric shall be placed loosely, not in a stretched condition. The gabions shall be placed so that the geotextile is not punctured. The gabions shall completely cover the fabric.

The fabric shall be placed on the slopes so as to provide a minimum overlap of 18 inches. The geotextile shall be placed parallel to the direction of the flow and the upstream or higher panel shall overlap the downstream or lower panel. At the top of the embankment the fabric shall be keyed into the ground a minimum of 18 inches.

21.11 GEOTEXTILE FILTER FABRIC INSTALLATION (Continued)

B. CONSTRUCTION (Continued)

2. Gabion/Embankment Stabilization (Continued)

The filter fabric shall be placed in the manner and at the locations shown on the project plans. The fabric shall be placed loosely, on and/or behind the gabion, not in a stretched condition. The backfill shall be placed so that the fabric is not punctured.

C. BASIS OF PAYMENT

No additional payment shall be made for filter fabric used in constructing weephole filter pockets for R.C. Channel Liner. The filter fabric and placement shall be considered subsidiary to the cost of the R.C. Channel Liner of the various depths.

Unless shown in the schedule of quantities as a bid item, no additional payment shall be made for filter fabric placed on, behind, or under gabion. All costs of materials, labor, and equipment for furnishing and placing the filter fabric with the gabion, as shown on the plans, shall be considered subsidiary to the cost of the Gabion, In Place, of the various types.

When shown in the schedule of quantities as a bid item, geotextile filter fabric, placed in accordance with the plans and these Specifications and accepted by the Engineer, shall be measured and paid for at the contract unit price bid per square yard for GEOTEXTILE FILTER FABRIC, IN PLACE, with no allowance for laps or toe-in anchorage. Such payment shall be full compensation for all filter fabric, slope preparation, installing the fabric, equipment, materials, tools, labor, and incidentals necessary to complete the work.

21.12 SUBSTANTIAL COMPLETION

Storm sewer work shall be considered substantially complete when all pipe is laid and backfilled; all manholes, inlets, and structures completed and backfilled; paving, sidewalks, and driveways replaced.

21.13 FINAL ACCEPTANCE

The project shall be considered eligible for final acceptance by the City when all required work is complete and accepted by the Engineer, all items on plan completed, final cleanup is complete, park space finished, and correction of all deficiencies found as a result of testing and/or final inspection by the Engineer.

21.14 GUARANTEE

At any time during the two year guarantee period, and within the time period allowed, the Contractor shall correct any defect in material or workmanship which has been brought to his attention. Such items shall include but not be limited to trench settlement including subsequent pavement damage, pipe leaks, and failures.